ENZYME-CASCADE ANALYSIS OF THE RIO TINTO SUBSURFACE ENVIRONMENT: A BIOSENSOR DEVELOPMENT EXPERIMENT.

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The EndoSafe Portable Test System (PTS), designed & developed by Charles Rivers Laboratories, Inc. (Charleston, SC) is a portable instrument that was designed to perform analysis of enzymatic assays related to rapid assessment of microbial contamination. The enzymatic cascade of Limulus Amebocyte Lysate (LAL) is known to be one of the most sensitive techniques available for detection of gram negative bacteria, yeasts and molds (future developments will include gram positive bacteria and archea), enabling the PTS to be evaluated as a potential life detection instrument for *in situ* Astrobiology missions. In the fall of 2003 subsurface rock samples from the Mars Astrobiology Research and Technology Experiment (MARTE) ground truth drilling campaign were analyzed using the LAL enzyme assay to determine if the PTS would be able to detect indigenous bacteria in the Rio Tinto subsurface. The Rio Tinto River system is an extreme environment that maintains acidic conditions and high iron and other metal ion concentrations despite seasonal temperatures and fresh water influx from rainfall & tributaries. The river is located in the core of the Iberian Pyritic belt, which is one of Earth's largest massive sulfide provinces. The data collected at this site was evaluated against contamination tracers (Sodium Bromide) and other biological analysis performed during the field season. The data shows that the LAL assay detected bacterial contamination in cores that had a high level of the sodium bromide tracer and hence verified that those cores were compromised by surface contamination due to the drilling process. The LAL assay also detected microorganisms in cores that had little to no sodium bromide tracer present, suggesting that the assay was able to detect indigenous organisms. In order for this technique to be utilized for *in situ* Astrobiology missions it will be integrated with an autonomous sample extraction and preparation system called the Biological Sample Extraction and Detection System (BSEDS). In 2005 the culmination of the MARTE project will be a high fidelity Mars drilling simulation and the BSEDS instrument will be one of the technologies included in the analysis suite.

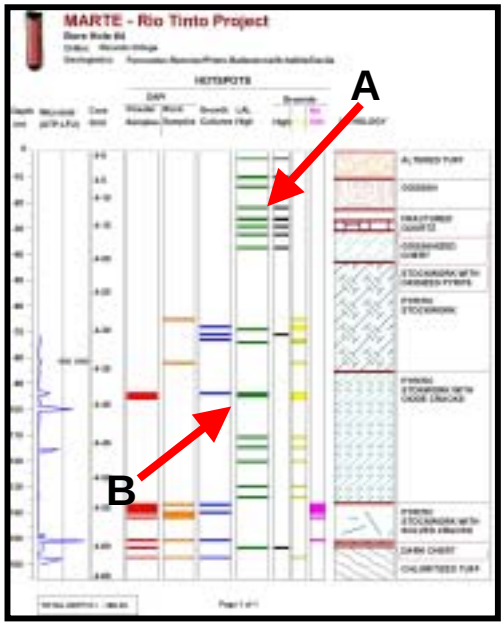

Figure 1. LAL analysis correlates well with the Bromide spiked contamination control tests (A) as well as DAPI staining and growth in culture (B).